

United States Government

Department of Energy

# memorandum

DATE: June 9, 1997

REPLY TO

EH-53 (R. Sastry, 301-903-4664)

ATTN OF:

SUBJECT: Chemical Safety Concerns / Search of Occurrence Reporting and Processing System (ORPS)

TO: Distribution

## Significant Occurrences

**May, 1997****Class 1:**

[Hanford](#) - explosion of chemical storage tank when contents react

**Class 2:**

[Fernald](#) - rapid overpressurization of waste storage container

**Additional:**

At Livermore, a crystal of high explosive precipitated from a solution of DMSO. At Los Alamos, an exothermic reaction took place in a chemical hood and started a small fire.

These occurrences are further described below with additional information, including Occurrence Report (OR) numbers, provided in the [Attachment](#).

A search of ORPS for occurrences having chemical safety relevance conducted for the month of May 1997 produced 23 reports representing potential chemical safety concerns. These occurrences are listed in the [Attachment](#). There was one "Emergency" occurrence. There were four occurrences categorized as "Unusual" with the remainder identified as "Off-normal". The Office of Environmental Management (EM) was Cognizant Secretarial Office (CSO) for 11 occurrences; Defense Programs (DP) reported six; Energy Research (ER) had three; Fossil Energy two; and Civilian RadWaste (RW) one. The CSO designation may change after the distribution of this monthly memorandum, and this change will be reflected in Quarterly and Annual Reviews.

In order to determine which chemical safety occurrences represent more important (significant) Levels of Concern, a classification scheme has been developed. The definitions of these Classes are as follows:

**Class 1** Occurrences characterized by an injury or exposure requiring hospital treatment, or confirmed, severe environmental effect; also occurrences that had the potential to cause these effects with all safety barriers down, except, for example, that no one was nearby to be injured or exposed, or escaped in time, or the climatic conditions were favorable;

**Class 2** Occurrences characterized by minor injury (first aid) or exposure, or minor environmental damage; also occurrences that were near misses (where one additional safety barrier remained to prevent consequences) to those in Class 1;

**Class 3** Potential precursors to the occurrences in Class 1 or 2;

**Class 4** Minor occurrences such as leaks, spills, or releases, which may be significant in their frequency of occurrence though not in their consequences.

There was one Class 1 occurrence and one Class 2 occurrence reported during May. There were 12 Class 3 occurrences. Among the Class 3 occurrences, in addition to those noted previously, were two involving potential exposures of workers to hazardous chemicals: one at Y-12 involving beryllium and the other at INEEL involving chlorine. At Hanford, a laboratory waste container was found with evidence of moisture accumulation and gas generation.

## Summary of Class 1 and Class 2 Occurrences:

**Chemical Storage Tank Explosion (DP):** (RL--PHMC-PFP-1997-0023) On May 14, 1997, at Hanford, an explosion occurred at the Plutonium Reclamation Facility (PRF), part of the Plutonium Finishing Plant (PFP) in the 200 West Area. The explosion occurred in Room 40 where bulk chemicals were mixed to support the now-discontinued plutonium recovery process. Information from air samples inside the facility and air monitors in the surrounding area show no signs of a radioactive release. No employees were injured, although several (8-10) were sent to a local hospital and some complained of metallic tastes in their mouths. A Type B Investigation is underway at Hanford; updates/results of this investigation will be posted on the Chemical Safety Homepage and will be summarized in an upcoming Quarterly Review. Also note that ES&H Safety Alert 97-1 (DOE/EH-0554), "Chemical Explosion at Hanford", was issued on May 22.

Investigators believe evaporation caused two substances inside the chemical tank to react and explode. Investigators believe the explosion was caused by a volatile mix of hydroxylamine nitrates and nitric acid. In 1993, a solution of nitric acid and hydroxylamine nitrates - heavily diluted by water - was put in the tank. The solution had a volume of 185 to 200 gallons. At that volume, the water kept the nitric acid and hydroxylamine nitrates in a safe, stable condition, but over time water evaporated out of the solution, and the vapor escaped through tiny openings in the tank. The volume of liquid shrank to less than 40 gallons - leading to much greater concentrations of hydroxylamine nitrates and nitric acid. The greater concentrations heated up the chemicals, causing them to react.

In an earlier, related occurrence involving the same chemicals, on December 28, 1996, at Savannah River (SR--WSRC-FCAN-1996-0030), a sump high-level alarm activated. Investigation determined that the source of liquid level increase was a warm canyon sump receipt vessel. Indications were that the vessel eructed resulting in some spillage of solution to the sump. Chemicals (hydroxylamine nitrate [HAN] and nitric acid) were added to the receipt tank in preparation of sump receipts to ensure criticality safety. Eructation of receipt tank contents occurred as a result of the auto-catalytic decomposition of HAN in the presence of strong nitric acid. Over a period of time, several sump receipts were made to the tank. The acidity and HAN concentrations in the sump receipt tank increased through the required chemical additions. At these conditions (including high temperature), the reaction initiated and proceeded to completion resulting in 250 gallons of solution being eructed to the sump.

**Rapid Overpressurization of Waste Container (EM):** (OH-FN-FDF-FEMP-1997-0034) On May 22, at Fernald, an employee heard an explosion-like sound and saw a flash of light from inside a building.

Emergency Response Team (ERT) members and the site Assistant Emergency Duty Officer responded. White dust or smoke was emanating from the building when they arrived. Two ERT members entered the building for an initial inspection. The responders reported smoke or dust being discharged from a white metal box, which appeared to be the source of the explosion-like sound. The responders could not read the codes or markings on the incident box, so they reported the codes and markings from surrounding boxes in an attempt to identify the contents of the box. The two responders walked outside of the building to discuss a plan of action when they heard two more "thumps" coming from the box. The responders subsequently transported the incident box out of the building to a controlled pad. Records listing the contents of the incident box were then retrieved. The box contained four 55-gallon drums of "129 material" (Dirty Prill, Code 5 Derbies, and Plant 1 Titan Mill Clean-out High U), one 55-gallon drum of "069 material" (Wet Sump or Filter Cake, Non-Oily and Non-Halide) with eleven drums of "069 material," 2 drums of "018 material" (Alumina Soda Lime with High Cl Content), and 1 drum of "002 material" (Sump Cake) dumped into the void space of the box.

All site operations involving packaging of potential hydrogen-generating materials were suspended. DOE-FEMP personnel notified the Nevada Test Site (NTS) EOC of this event and recommended restricting operations with similar containers that have already been shipped to the NTS. The cause for the event is still being investigated.

There was no detectable spread of contamination beyond the building and initial air sample results do not indicate any significant release of airborne contaminants. The area where the rapid overpressurization occurred was not occupied at the time of the event and there were no personnel injuries. Damage to equipment and facilities was limited to the incident container.

Also note that the Class 3 occurrence at LLNL (SAN--LLNL-LLNL-1997-0029) involving the precipitation of an explosive crystal from a DMSO/HE solution was preceded by a nearly identical occurrence (SAN--LLNL-LLNL-1996-0025) in June 1996. All DOE sites working with DMSO/explosive solutions should be aware of these occurrences.

Additional information regarding these occurrences and others will be discussed in an upcoming Quarterly Review. As occurrence reports are finalized, lessons learned will be communicated.

[Signature of]

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**Office of Field Support**

[Attachment](#)

#### **Note to Distribution:**

This report is distributed via e-mail either as a WordPerfect or a text file. Please contact **John Usher** (516-344-2096, Fax: 516-344-3957, E-mail: [usher@bnl.gov](mailto:usher@bnl.gov)) at Brookhaven National Laboratory to be placed on e-mail distribution. If you want to receive hardcopy, please contact John Usher who will make every effort to accommodate you.

The DOE Chemical Safety Program homepage is now available. The Internet address for this site is [http://dewey.tis.eh.doe.gov/web/chem\\_safety/](http://dewey.tis.eh.doe.gov/web/chem_safety/). This report is accessible using the Chemical Occurrences link via the homepage.

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